

NAVAL POSTGRADUATE SCHOOL

Monterey, California



THESIS

**STRATEGY AND GUIDELINES FOR
TRANSITIONING A HELICOPTER SQUADRON
TO THE DEFENSE MESSAGING SYSTEM
WITHIN THE IT 21 CONCEPT**

by

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March 1998

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SYSTEM WITHIN THE IT 21 CONCEPT**

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Submitted in partial fulfillment
of the requirements for the degree of

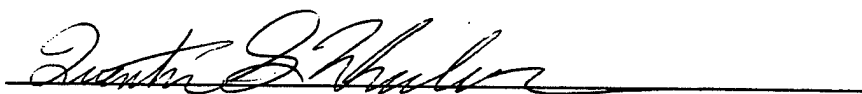
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from the

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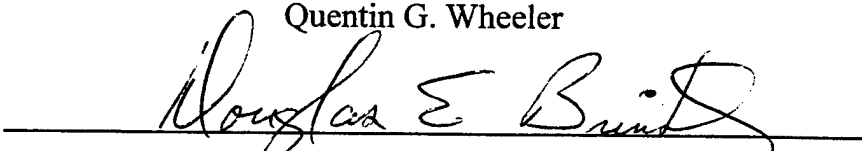
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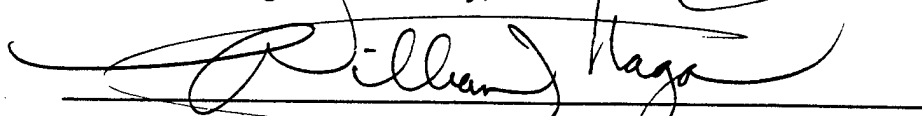


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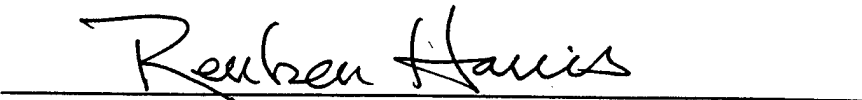
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ABSTRACT

IT 21 is the Navy's program to establish standards for fleet units to have the necessary computing infrastructure to support emerging and future requirements. One of the cornerstones of next century's command and control system is the Defense Messaging System (DMS) which replaces AUTODIN. This thesis gathers existing program information and literature, filters the information, and provides the relevant information in one source. The result is a strategy and methodology that achieves DMS and IT 21 objectives. It recommends an architecture that is flexible for future growth, provides group collaboration opportunities, and maximizes shared databases. Additionally, a strategy for purchasing network components and DMS training is recommended.

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I. INTRODUCTION

This thesis examines the migration of a Naval Aviation squadron to the Defense Messaging System (DMS) within the Navy's guidelines for information technology for the twenty-first century. The current Defense Department messaging system, AUTODIN, will be phased out in 1999. DMS replaces AUTODIN and ushers in new challenges and capabilities for the squadrons. The implementation of the new messaging system provides an opportunity to examine new methods of handling messages and the establishment of a baseline topology and architecture for computing expansion.

The transition to the Defense Messaging System is an evolutionary change from AUTODIN.[Ref.1] DMS will bring multimedia messaging to the desktop. With this evolutionary change, a new process of handling messages may need to be implemented. Introduction of a new technology requires a change in work habits and thought processes. [Ref.2] DMS components and software will operate and interact at the squadron level. [Ref.3] The computer networks in most squadrons may require significant upgrades.

This is where the Navy's vision for information technology for the twenty-first century enters the equation. It establishes guidelines and standards for hardware and software that is being implemented in the fleet. The vision is to have the hardware and software identified to support computing requirements for the fleet in the next century.

A. WINDOW OF OPPORTUNITY

These two high profile programs provide a window of opportunity to redefine all message related processes and increase the efficiency and responsiveness of a squadron. There should be an optimum way to implement the programs and requirements to maximize the value to the squadron.

This thesis seeks to find the optimal mix for the squadron given the circumstances. We will examine the process of combining the DMS transition with the twenty-first century information technology guidelines to produce a baseline architecture that enhances information flow, message handling, and administrative productivity.

B. METHODOLOGY

The methodology used in this thesis research consisted of reviewing applicable resources on the DMS program, the Navy's information technology initiative, redesigning business practices, and computer networking. Publications from the DMS program office and Department of Defense provide large amounts of information concerning these programs. Analysis of the books, magazine articles, web sites, and CD-ROM systems concerning the subject to provide a central point for relevant information needed for the squadron level. Applicable background program information and an implementation strategy are presented and referenced in a one stop check list style approach. The education provided by the Information Technology Curriculum at the Naval Postgraduate School combined with 17 years involvement with Naval Aviation shape my views as to the optimum strategy to accomplish the transition.

II. INFORMATION TECHNOLOGY FOR THE TWENTY-FIRST CENTURY

In warfare, information superiority will significantly increase the speed of command, enabling forward deployed and early-entry forces to take the initiative away from numerically superior enemy forces and set the conditions for early, favorable termination of conflict.

1996 Quadrennial Defense Review Secretary's Report to Congress

In a world of increasing uncertainty, warfighters in the twenty-first century must employ and support their forces more efficiently than ever before to maintain the tactical edge.[Ref. 4] The QDR gives us the impetus necessary to make fundamental changes in the way we conduct military affairs, to change our processes and to work more efficiently. It gives us not just the opportunity - but the requirement - to carry our day to day business smarter. Information superiority is the foundation of battlefield dominance. Network warfare, robust infrastructure and information distribution to dispersed forces are all key elements to achieving information superiority. [Ref. 4]

IT 21 is being implemented throughout the fleet. It is an alignment of existing Command, Control, Communications, Computers and Intelligence (C4I) programs to focus on accelerating the transition to a PC based tactical and warfighting support network. The goal of IT 21 is to link all U.S. forces and eventually even our allies together in a network that enables voice, video, and data transmissions from a single desktop PC, allowing warfighters to exchange information. It will achieve the critical mass for a "network-centric warfare environment." This is an environment in which units and assets are linked through

a common network that provides access to services, information, software applications, communications, and transactions. The information can be classified or unclassified, tactical or non tactical. To do this we must build a system to industry standards using commercial off the shelf technology (COTS), without stove pipes, in a client-server environment that allows the pull of needed information in a way that is seamless to the user in the field.

A joint message from CINCPACFLT and CINCLANTFLT, in coordination with the Department of the Navy Chief Information Officer (DON CIO) established the implementation standards (Appendix A) for information systems of fleet units and bases. IT 21 policy requires all non standard network operating systems and E-mail products be replaced by December 1999.

III. DEFENSE MESSAGING SYSTEM

Concurrent to IT-21's implementation, is the discarding of the thirty-year-old process for handling military messaging. The Autodin messaging system developed in the sixties is being replaced with the Defense Messaging System (DMS). DMS is a cornerstone of Command, Control, Communications, Computers and Intelligence (C4I) programs for the Warrior. It will provide command and control messaging for the Global Command and Control System.[Ref. 5] DMS will be implemented with COTS products and will increase the speed and security of messaging while also adding increased reliability and capacity.

DeLoria [Ref. 6] and Pentall [Ref. 7] provide overviews of DMS. Their articles provide the framework for this chapter.

DMS provides secure messaging fully integrated with the global DOD directory service. It has a robust set of services that will work writer-to-reader, desktop-to-desktop in DOD and externally. With these capabilities, access to global directories from anywhere in the world is available, complete with addressing, security, and user capabilities information for all the messages composed and received at your desktop.

DMS has been a long time in the planning stage. In conjunction with the Joint Staff, the DOD Services and agencies established the general DMS requirements. Figure 1.

DMS takes organizational messaging and individual e-mail messaging and brings them together in a single system based on a single set of standards. This allows different brands of standards-based products to operate with each other without the use of gateways to translate the proprietary systems.

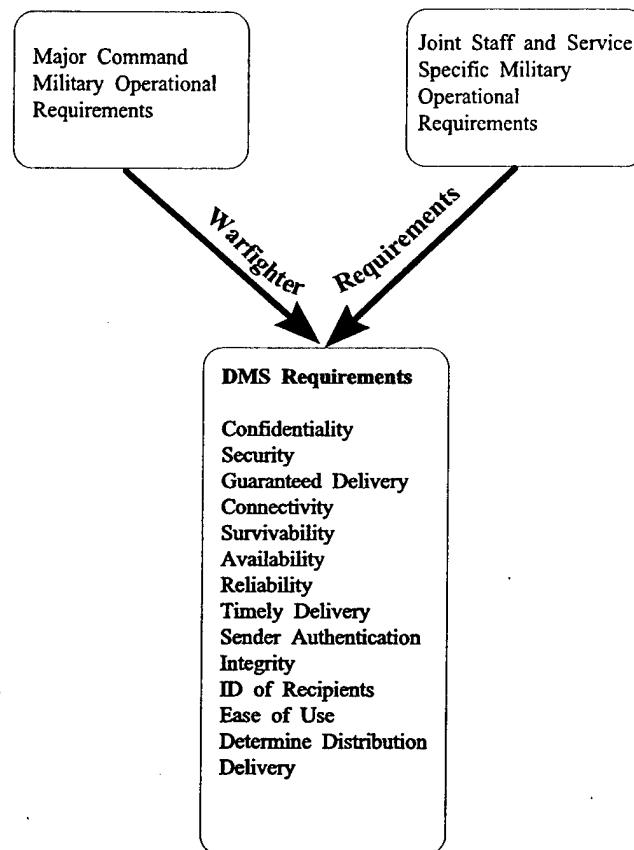


Figure 1. Warfighter Requirements

A. ARCHITECTURE AND COMPONENTS

The DMS architecture consists of; the message handling system, directory system agents, and DMS management and control functions designed to keep the infrastructure up and running. Figure 2. Larson [Ref. 4] describes these components.

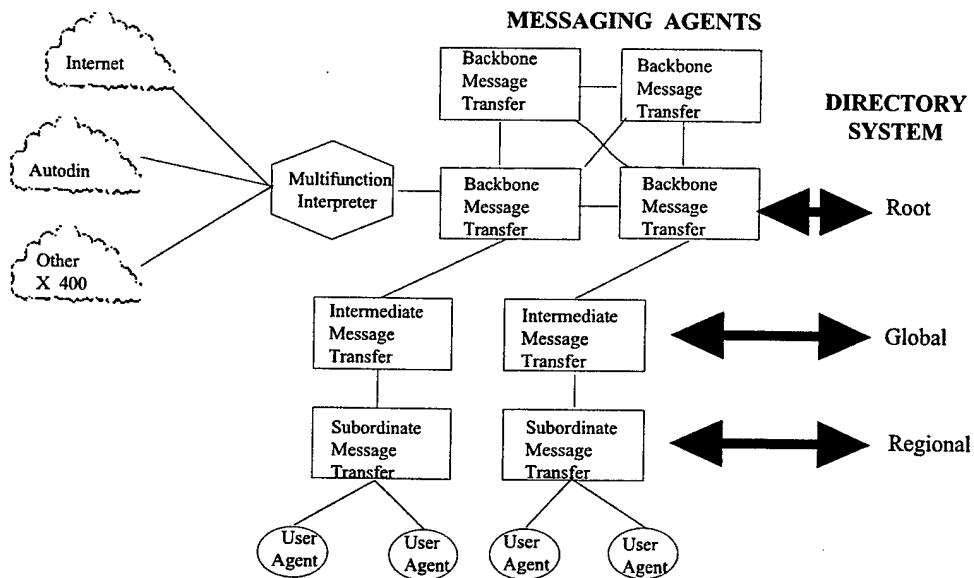


Figure 2. DMS Architecture

1. The Message Handling System

The message handling system employs the International Telegraph & Telephone Consultative Committee (CCITT) X.400 handling system standards and protocols. CCITT is now the International Telecommunication Union (ITU). Components include:

- Message transfer agent, which provides message switching to route messages through the underlying network from source to destination.
- Message Store, which provides mail box functions to store messages for recipient until they are accessed.
- User Agent, the message system interface to the user for message preparation, sending, receipt and processing.
- Profiling User Agent, which provides for receipt, analysis and onward distribution of organization messages.
- Mail List Agent expands a single mail list address to a list of recipients and off-loads the work of expanding mail address lists from the user agent.
- Multifunction Interpreter, which provides interfaces with non-DMS users such as NATO allies and appropriate civilian organizations. It also provides transitional interfaces between DMS users and AUTODIN, SMTP and versions of X.400.

2. Directory System

The DMS directory system employs the ITU X.500 standard and protocols for services.[Ref 8] Through this X.500 standard, an automated DOD wide directory of users with names and addresses is maintained. Additionally, data about users' authorizations, privileges, and identification is maintained. Directory components include:

- Directory System Agent (integrated with the User Agent), which stores directory entries, addressing entries and security information about all of the DMS users.

- Directory User Agent, which accesses the Directory System Agent to retrieve info.
- Administrative Directory User Agent, which provides the capability to create, update and maintain entries in the Directory System Agent maintained directory.

3. System Management

DMS management involves a hierarchy of management centers. The Global Control Center (GCC) provides the top-level status and procedural management of the system. Pointers are maintained to other GCCs and organizational routing information. Three Regional Control Centers (RCCs) perform infrastructure component management and control the Message Transfer Agents (MTAs) routing tables. Local Control Centers manage site assets and support site users.

The infrastructure will be paid for by DISA, put on the ground by DISA, and managed and maintained on DOD computers. DISA will be providing the end to end information transfer network to support military operations. DISA is responsible for the transport and routing of voice, circuit switched data, packet switched data, video and point to point bandwidth services for wide area, local area and metropolitan area networks. DISN connectivity to the bases is through a service delivery point. [Ref. 9] The delivery points will provide access to a base fiber optic cable distribution system. The fiber optic cable will connect the various base buildings and provide firewall protection and web access. This base infrastructure will support real time fleet requirements.

B. SENDING A DMS MESSAGE

The DMS solution incorporates unique products and ideas to meet performance, architecture and security goals. These products reside on the user or organization's computer systems. One of these products is the Message Store.

The Message Store allows users to turn off their PC, go home at night, or move from one place to another while messages continue to be delivered. Obviously, the command wants to be alerted when a high priority message comes in. The Message Store provides that alert. It allows commands to preregister certain capabilities like auto forwarding. Commands can auto list messages, or you can get a message summary based on certain parameters. The Message Store is accessed by the user through the User Agent.

The User Agent is the main product residing on the organizational computer system. It is X.400 based and lets individuals compose messages and submit them to the system for ultimate delivery to the intended recipients.

Integrated into the User Agent is the Directory User Agent that lets individuals access the local directory cache for addresses used on a regular basis, as well as access the global X.500 directory for those addresses that are not in your local organization computer system's cache.

Sending a message is not very different from using the current email systems. Figure 3. From your local computer, the FORTEZZA card, or it's security replacement, is inserted into the PC card slot. Click on the User Agent application and login with a userID and password. The password may be different from the pin number programmed onto the card.

The user ID, corresponding password and PIN number authenticates that you are who you say you are and allows you to run the User Agent program. You can now start reading and writing messages.

Individual places Fortezza card
in computer



Login:

**User ID
Password
PIN**

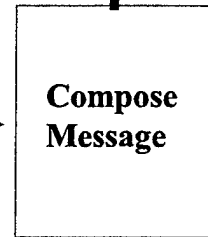
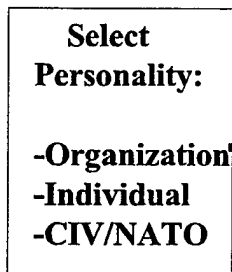


Figure 3. Sending a Message

The second thing that may come up is a screen asking for your personality. That personality is based on your requirements within your mission area. The individual personality allows an individual to compose and submit individual messages - roughly equivalent to the e-mail. If you have been granted message release authority, e.g., you've been granted the authority to send and receive messages that speak on behalf of the organization, you may have an organizational personality.

When constructing messages to the people the command does business with, commands will normally have them listed in the local address book. They will be aliased in such a way that, usually, just the first name will call that recipient up and transparently bring in addressing information.

With X.400 and DMS, the drafter will be able to electronically build messages on the screen and forward them to the ultimate message release authority, either directly or through a review chain. This will allow the reviewers to edit and make comments, coordinate with the drafter or let the message go directly to the release authority. When the releaser actually releases the message, a copy will go back to the drafter so he can see what was actually sent and be able to follow-up.

On the other end, the recipient will be responsible for distribution determination to make sure that organizational messages get to the proper action or information officers. That can be done two ways. If it is a small office environment without a LAN, perhaps the distribution determination can be done manually and the message delivered to those who need it. In the case of a large command where the commander gets information and wants

need it. In the case of a large command where the commander gets information and wants to disseminate it to the troops, you might use a Profiling User Agent to perform distribution determination and onward delivery through the command LAN, based on the content of the message and the profile programmed by the recipient.

For individual messaging, messages are sent directly from the originator to the intended recipient. Individual messages are normal business oriented messages sent by individuals, and roughly correspond to e-mail in today's environment. You need only apply appropriate addresses on the message, and it will go directly to that person.

1. Precedence and Priority

Precedence reflects the importance of the message and, thus, the urgency and speed required for delivery from writer-to-reader. There are six precedence values used by DOD - routine, priority, immediate, flash, emergency command precedence and CRITIC. Precedence will be assigned to every message for action and info. These are assigned within the content of the message and are primarily used for message handling.

The message envelope has three priority levels - urgent, normal and nonurgent. The priority is used by the Message Transfer System to ensure messages are delivered first in/first out based on priority to achieve required speed of service.

The recipient will be alerted when urgent messages are delivered to either the Message Store or the User Agent. The highest precedence authorized for a particular user to apply to messages during composition is programmed into that user's FORTEZZA card.

The UA interface will not allow the user to apply any precedence higher than that indicated by the privileges on the card.

2. Alternate Delivery

Another very important service that we expect from X.400 is the alternate delivery ability. There are going to be times when the intended recipients are not available. Either they have gone away or they are off line or the MTA is down. We need to make sure the message is delivered to a responsible individual who can take appropriate action. There are several ways to do this in X.400.

Originator requested alternate delivery allows the originator of the message to indicate an alternate delivery location if the intended recipients are not available. The originator can include that information in the message. If the message cannot get to the intended recipient, it will be delivered to the alternate. The originator would also include the security information for the alternate recipient.

Recipient assigned alternate delivery is used by the recipient if he knows he is going to be off line or in a mobile situation where he will be jumping from one site to another. He can tell the MTA, "I'm going to be gone for a little while, send all my messages to so and so." The recipient assigned alternate delivery will allow that to happen, and the message will be delivered. Alternate recipient assignment is a message transfer system capability, not so much a user agent capability.

Alternate recipient assignment gives the MTS a recipient address to be used if an MTA is unable to determine where to route the message. This address loosely corresponds

correct the situation that caused the non delivery and attempt to deliver the message to the intended recipient. In all alternate delivery scenarios, a non delivery report is sent back to the originator stating the reason for the non delivery.

3. Autoforwarding

An additional capability is autoforwarding. Autoforwarding allows a delivered message to be automatically sent to another recipient based on information in that message. Message Stores or UAs can do the forwarding based on particular parameters of the message.

4. Delivery Reports and Receipt Notification

X.400 also provides the user with delivery reports and receipt notifications. In most cases when the command sends a message, you want to be sure it reaches its destination, especially if that message is mission critical. The MTA servicing the intended recipient will send back a delivery report, when asked for by the originator, if it can deliver the message. If it cannot deliver that message, it will send back a non deliverable report.

There is a difference between delivery and receipt. Delivery occurs when your MTA delivers the message to your User Agent. Receipt occurs when you actually access the message. There are some special cases where a non receipt notification would be appropriate. For example, a message delivered, but autoforwarded to an alternate recipient would generate a non receipt notification that is sent back to the originator.

The signed receipt is another very important element added by the message security protocol. When building a message, commands sign the message with the electronic signature based on the information on the FORTEZZA card. To be certain that a message reached its destination and that the person who received it cannot deny receiving it, the MTS of the recipient signs the receipt and sends it back to the originator.

IV. BENEFITS OF INFORMATION TECHNOLOGY

Information technology implemented to support DMS will breakdown traditional task oriented boundaries resulting in a more efficient squadron. To measure improvement, the analyst must be aware of the total technology impact. Historically, studies on information technology productivity have focused on tangible, measurable benefits of the funds spent such as reduced labor costs and increased production capacity. Measures of performance that were holdovers from the industrial age were being applied to the information technology age. Traditional methods for capital investment, such as return on investment, failed to capture all the positives associated with increased funding to information technology. Moreover, the studies generally focused on resulting current benefits and did not focus on long term benefits. [Ref. 10] Thus, the studies did not consider the total benefits derived from the technology implementation. In short, the metrics were wrong.

The benefits of information technology results can be positive in many respects when measured over time. Traditional metrics do not account for increased customer satisfaction, increasing company responsiveness, and increased flexibility to achieve goals. [Ref. 11] Information sharing is an information technology by-product. Sharing information can result in more knowledgeable personnel who could apply this information in everyday practices. If empowered, these personnel could align daily actions and decisions with squadron goals. Also, information empowered personnel are more valuable in redesigning business processes and decreasing the applicable cycle times. "Hands on" personnel in the organization

processes have keen insight to improvement. The benefits of information sharing and process improvement may not be readily apparent in the short term but will significantly benefit the squadron or organization over the long haul. Implementation of enhanced information technology in the squadron will result in reduced costs, shortened cycle times, and increased responsiveness to the mission and assigned personnel. [Ref. 12]

V. STRATEGIC PLAN

A. FOUR PHASE PLAN

The warfighting community has embraced the idea of network centric warfare. The push is on to bring all units to a minimal level of information exchange that will be required now and in the future. Building a new information system is a form of planned organizational change that involves everyone in the command. The change in information systems, which will occur during the DMS/IT 21 transition, involves changes in work habits, management techniques, and organizational responsibilities. Information systems can cause powerful organizational change if they are used to redesign current practices. The strategic plan to implement the new technologies and maximize possible benefits is adapted from John Byrne's article on building a horizontal corporation [Ref. 12]:

- Phase 1- Identify Strategic Objectives
- Phase 2- Define Core Processes
- Phase 3- Organize Computer Network to Support Core Processes
- Phase 4- Revamp Training and Budget to Support the New Structure

B. IDENTIFY STRATEGIC OBJECTIVES - PHASE I

Strategic objectives for the aviation squadron should be:

- Have an operational DMS system before the transition deadline.
- Install a computing infrastructure to support DMS and future network growth.

- Maximize group collaboration capabilities.
- Maximize shared databases.
- Large File Storage Capabilities.
- Internet Access.

These objectives allow migration at various rates. Implementation can be in one step or spaced over time. The budget will be the determining factor. The objectives of an operational DMS network and computing infrastructure are more immediate in nature. The infrastructure established in support of these objectives would directly effect the remaining objectives' effectiveness. The objectives of group collaboration, shared databases, and large storage capacities will be most effective if computer access is widespread coupled with adequate bandwidth.

VI. CURRENT SQUADRON STRUCTURE AND PROCESSES

The goals and targets for DMS and IT 21 programs have been identified. However, to navigate to our strategic goals we must understand the current capabilities, functions and processes of a helicopter squadron. Onorati and Robillard [Ref. 13] provide an excellent view of current squadron structure and processes. The structure section below is adapted from their work.

A. SQUADRON STRUCTURE

1. The Strategic Apex

The naval aviation squadron, like most military organizations, is based on a rigid vertical command-and control hierarchy. At the top of the hierarchy is the Commanding Officer (CO) who is responsible for the squadron and its happenings. As with most military organizations, the CO is given absolute responsibility for the command and the authority to back it up.

Directly under the CO in the pecking order is the Executive Officer (XO). The XO is a screened Commander who will fleet up to take command of the squadron when the present CO's tour is complete. The XO is considered the administrative head of the squadron, with all paperwork and information flowing through his/her office. The XO heads most squadron boards and committees. His responsibilities free up the CO to lead the squadron without allowing him/her to get buried in minutia.

The third member of the "strategic apex" is the Command Master Chief (CMC). The CMC is generally the senior enlisted member in the squadron and is responsible to the CO for the morale and discipline of the enlisted personnel assigned.

The strategic apex of a squadron controls the strategic planning and goal setting of the organization. Policy and tasking are directed downward, with the understanding that the status of assigned tasks be reported back up the chain. This level represents the highest overall decision-making authority in the squadron, both administratively and operationally.

2. Departments

Under the strategic apex, a squadron is divided into functional units called departments. A department is directly responsible to the strategic apex for achieving certain functional duties within the squadron. The departments operate autonomously, each with differing and sometimes conflicting agendas. Each department is headed by a LCDR (0-4) who reports directly to the strategic apex and has the responsibility for the operation of their department.

The four departments are Maintenance, Operations, Administration, and Safety. Although squadrons exist with additional departments, these four are the core departments.

Figure 4.

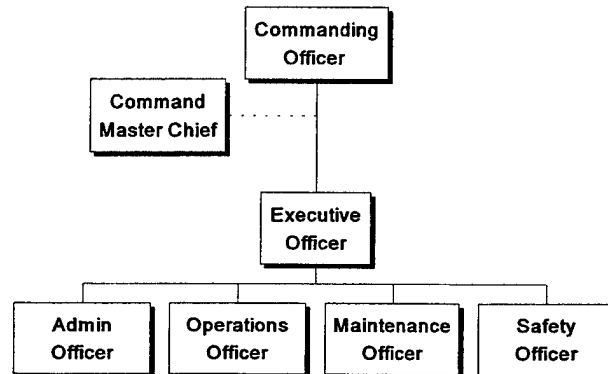


Figure 4. Strategic Apex and Department Heads

a. Maintenance

Maintenance is the largest department in the squadron and is tasked with the physical maintenance and support of the aircraft assigned. It is unique among the departments in that it is assigned the majority of the squadron's enlisted personnel.

The Maintenance department has its own strategic apex in the Maintenance Officer (MO), the Assistant Maintenance Officer (AMO), and the Maintenance Master Chief. They have a support staff of chiefs and Aviation Maintenance Administration Specialists (AZs) who all operate out of Maintenance Control. Maintenance Control coordinates the maintenance effort on all the aircraft and serves as the operational point of command for the individual work centers in the department. The workcenters liaison directly with Maintenance Control for all maintenance related activities and aircraft problems. Maintenance Control also serves as the duty officer's link with the Maintenance department in the execution of the daily flight schedule.

Because of its size and many specialized ratings, the department is further sub-divided into divisions, branches, and workcenters, each with an officer or a chief responsible for its management. These divisions and branches represent the administrative chain of command within the department and exist to divide the department into manageable units. Figure 5 represents the chain of command within the department.

It is important that the difference between the operational and administrative chains of command be understood. Operationally, a Shop Supervisor reports directly to Maintenance Control on any matter dealing directly with the maintenance effort and his/her

shop's responsibility. If it has anything to do with the maintenance of aircraft, the operational chain is used. If the same Shop Supervisor wants to take leave, needs and evaluation, or gets into legal trouble, it is handled through the administrative chain. The Division and Branch Officers are responsible for the tasks necessary to keep the personnel in their respective division/branches happy and able to work. Generally, if a matter does not deal directly with maintaining aircraft, it belongs to the administrative chain.

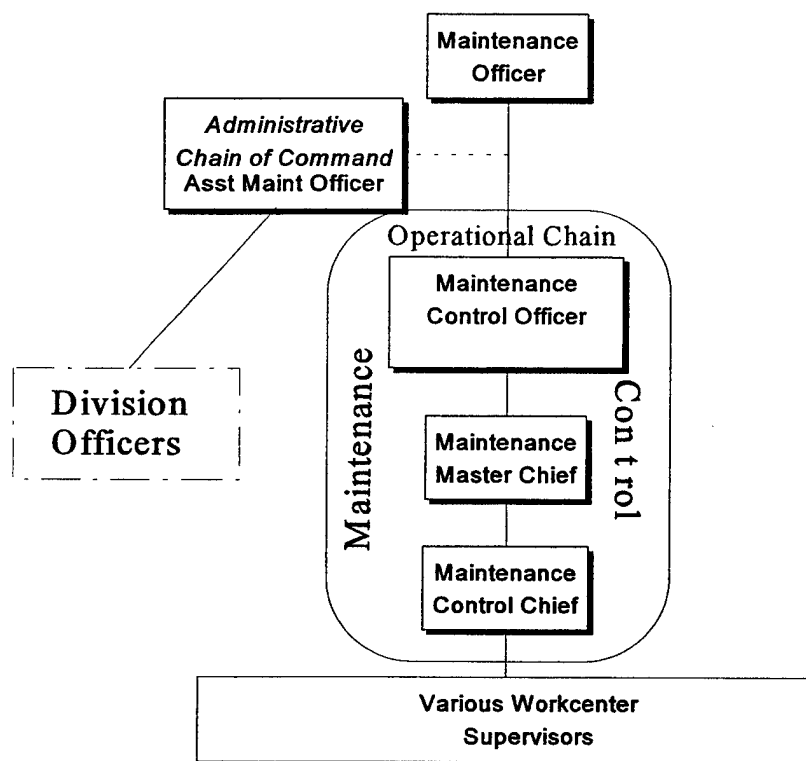


Figure 5. Maintenance Department

b. Operations

The Operations department is responsible for the planning and execution of the squadron's activities. These include but are not limited to:

- Coordinating the operational aspects of all squadron movements and deployments.
- Monitoring the progress of all airborne aircrew training.
- Maintaining and updating flight log books.
- Creating and publishing the daily flight schedule.

The department is headed by the Operations Officer and is assisted by officers under him/her. Typical jobs in the department include Assistant Operations Officer, Schedules Officer, Tactics Officer, Intelligence Officer, and Training Officer. Depending upon the squadron, the Training Officer may have his/her own department. A small number of enlisted personnel are usually assigned to handle administrative and intelligence duties. The Operations Yeomen perform any administrative tasks required by the operations staff. Specialists work closely with the Intelligence Officer to provide support to the aircrew. Typical Operations structure is presented in Figure 6.

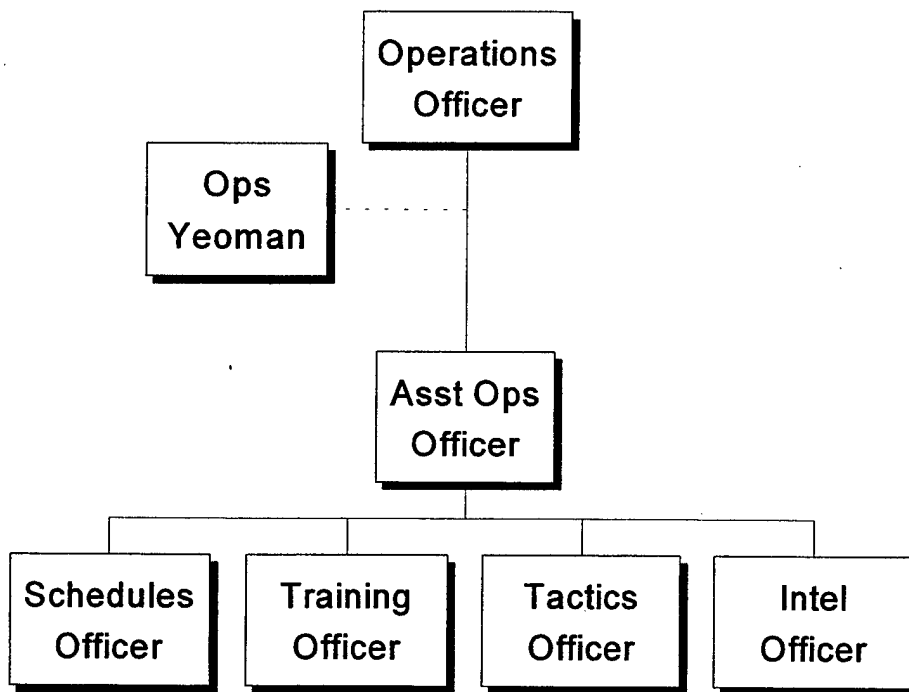


Figure 6. Operations Department

c. Administration

The administration department supports the squadron's personnel and handles the paperwork burden for the strategic apex. Their areas of responsibility include, but are not limited to:

- Maintaining the service records of all squadron personnel
- Performing any word processing required for squadron personnel such as evaluations, awards, promotions, and articles.
- Maintaining the instruction library for the squadron.
- Performing legal services for the CO/XO.
- Updating and maintaining message traffic.
- Coordinating and tracking advancement requirements for enlisted personnel.

The department is run by the Administrative Officer (AO) and is divided into separate halves under him/her. The Personnel division is headed by the Personnel Officer and is tasked with supporting the squadron's enlisted members. The Personnel office performs all service record business, promotion proceedings, and discharges. The office is also responsible for tracking squadron manning.

Admin division is headed by the Assistant Administrative Officer and handles all departmental matters not directly involved with enlisted personnel support. The Admin division also liaisons closely with the strategic apex for direct tasking. Typical jobs in the

department include Personnel Supervisor, Personnel Staff, Legal Officer, Public Affairs Officer, and First Lieutenant. Typical Administration structure is presented in Figure 7.

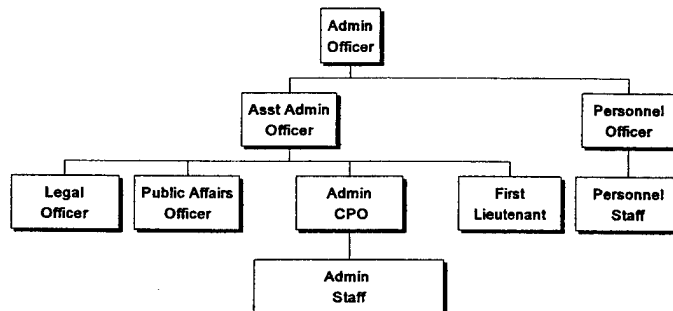


Figure 7. Administration Department

d. Safety

The Safety department is the smallest department in the squadron and is charged by the CO to uphold and promote his/her safety policy. The department head is the Safety Officer, usually a graduate of the safety school in Monterey, CA. In addition to running the department, the safety officer is trained to act as command coordinator if a mishap occurs in the squadron. Other departmental responsibilities include:

- Maintaining the squadron's NATOPS records and publication library
- Conducting safety/NATOPS training for aircrew and shop personnel.

- Conducting NATOPS check rides for aircrew.
- Conducting periodic safety meetings with designated command representatives.

The department is generally assigned only three to four officers and one senior enlisted person. The typical jobs include NATOPS officer, Ground Safety Officer, and Safety Chief. The structure is shown in Figure 8.

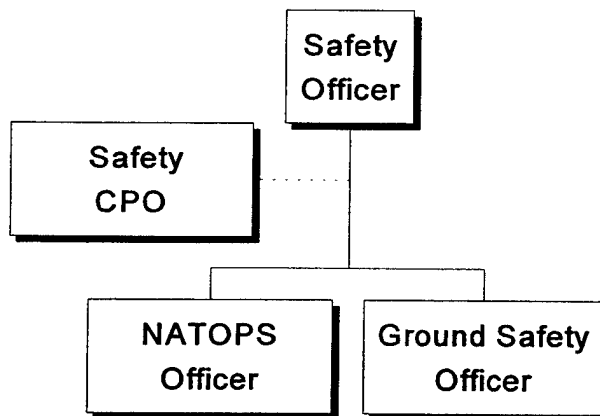


Figure 8. Safety Department

B. CORE PROCESSES - PHASE II

We will use the following charts to model squadron process information to reveal duplication of effort and weaknesses. IDEF charts will be used. IDEF stands for ICAM Definition, and ICAM stands for Integrated Computer Aided Manufacturing. IDEF will model the data processing and information flow to better understand input/output relationships. IDEF will model the system as a whole, depicting all of the inputs from the outside environment, into the system and what is eventually produced by the system. Each squadron activity can be decomposed into lower level activities until the desired level of refinement is obtained. The top-level is shown in Figure 9. Lower level charts are shown in Appendix B.

The department level models in the appendix illustrate the inefficiencies that exist with the squadron process structure. Many of the same processes are performed in numerous locations in the squadron and the information infrastructure is outdated and fragmented. Processes exist in each department for the keeping of records specific to the tasks performed. Administration, Personnel, Maintenance Admin, and Operations Admin all perform identical tasks for their particular departments or divisions. This duplication of effort results in inefficiency and difficulty in integrating information systems thinking across organizational boundaries.

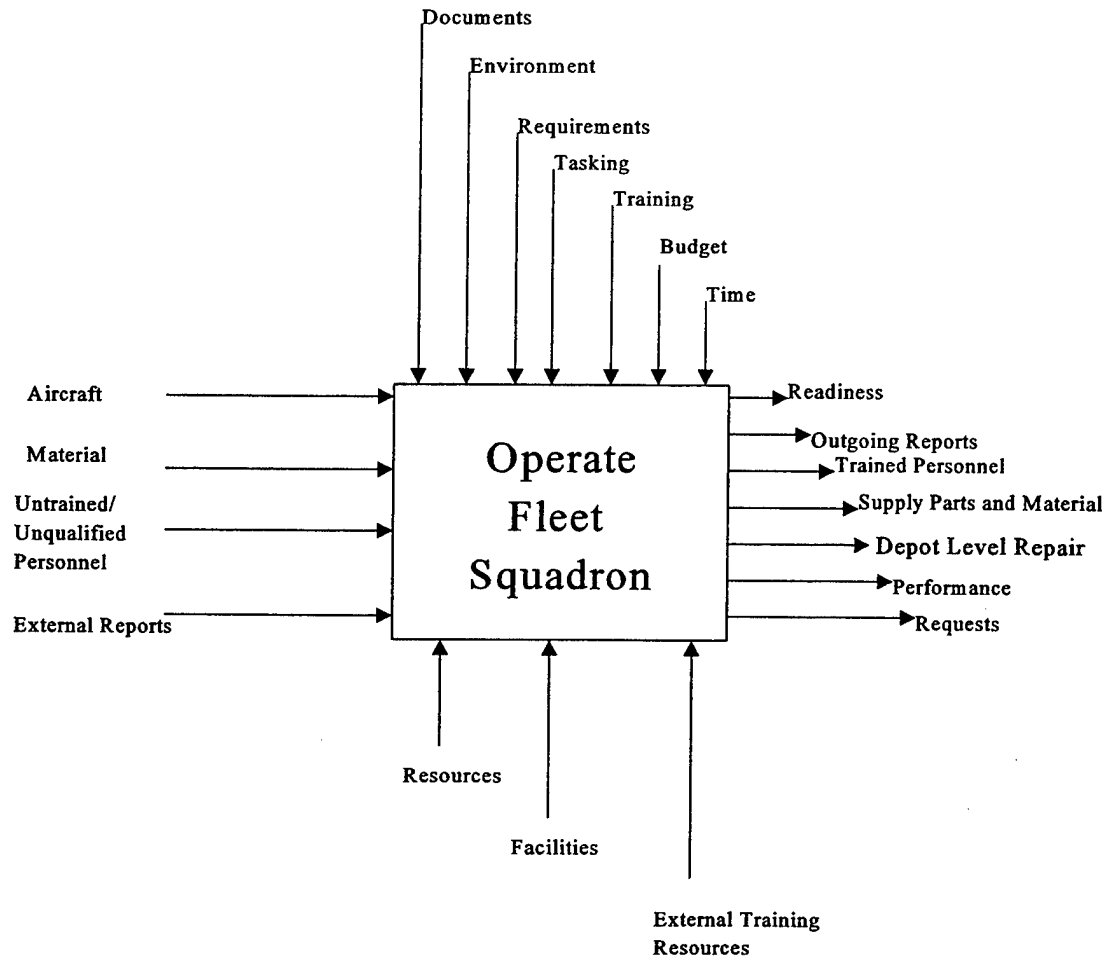


Figure 9. Squadron Level IDEF

The core processes that can be extracted and deduced from the charts are:

- Accomplishing the mission.
- People support processes.

The outputs of readiness, outgoing reports, trained personnel, supply parts and material, aircraft repair, performance, and requests all support these fundamental processes. These two processes must be focused on if squadron strategic goals will be accomplished.

VII. PLANNING THE NETWORK

Planning is the most important part of setting up the squadron network. We will design an infrastructure that will support our strategic objectives. The network will meet current needs while providing resources and capacities for future growth. The network will be designed to support our core squadron processes of mission accomplishment and personnel support. Designing the network marks the beginning of Phase III.

A. ORGANIZE THE NETWORK TO SUPPORT THE CORE PROCESSES - PHASE III

From the IDEF diagrams we resolved who the key players are who drive the core processes. These players will become nodes in which we will orient our network. The planning and designing process will focus on three areas:

- Determining Messaging/Email Requirement
- Evaluation of Current Inventory
- Software Strategy

The sending and receiving of messages in the squadron is primarily accomplished by the CO, XO, and department heads. Their need to conduct business with personnel in other commands and agencies requires them to have messaging capability. We will place a LAN node with each of these individuals and the command Master Chief. Figure 10 illustrates this concept.

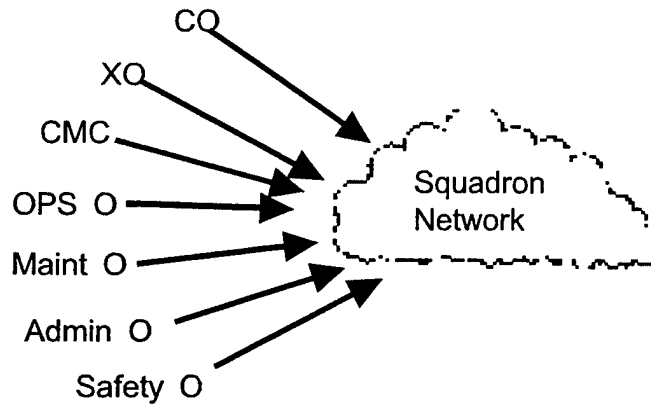


Figure 10. Minimum Network Nodes

B. EVALUATE CURRENT INVENTORY

To minimize procurement costs and to plan the integration of current assets, we must conduct a survey of existing conditions. From this comprehensive list we can decide what equipment can be effectively utilized in the network. The survey will determine the following information:

- **Current Computer Usage** - This is helpful in determining the type of current computers, installed hardware and the quantity and type of data link equipment required.
- **Printer Usage** - This step will identify additional equipment such as print servers that might be required.
- **Current Software** - This may suggest whether a change in licensing schemes is appropriate. As the LAN grows, the software must be scalable to meet the increased needs.
- **Existing Network** - The existing network must be compatible with the planned LAN. If not, a migration and utilization strategy should be developed.

Once the survey list is complete, the hardware and software must be balanced against IT 21 requirements. Discarding of non conforming products and software is not recommended. However, placing these products in nonessential network roles and planning a migration strategy to IT 21 compliant products is recommended.

C. SOFTWARE

Most choices for software that have been mandated by IT 21 and are sound. Network software is the Windows NT series. This package meets all our networking protocol and scaling requirements. Additional software for Email (Microsoft Exchange) and office productivity (Microsoft Office 97) are also specified by IT 21. For DMS considerations, the LAN will require a user agent/directory user agent software package. This is not funded by the command.

D. RECOMMENDED NETWORK

By combining our requirement for the nodes with our strategic objectives of a DMS enabled network, shared databases, group collaboration, Internet access, and large file storage, we arrive at the configuration illustrated in Figure 11. This network provides flexibility, redundancy, and expansibility. If the squadron is fiscally constrained, each component can be added when budget allows.

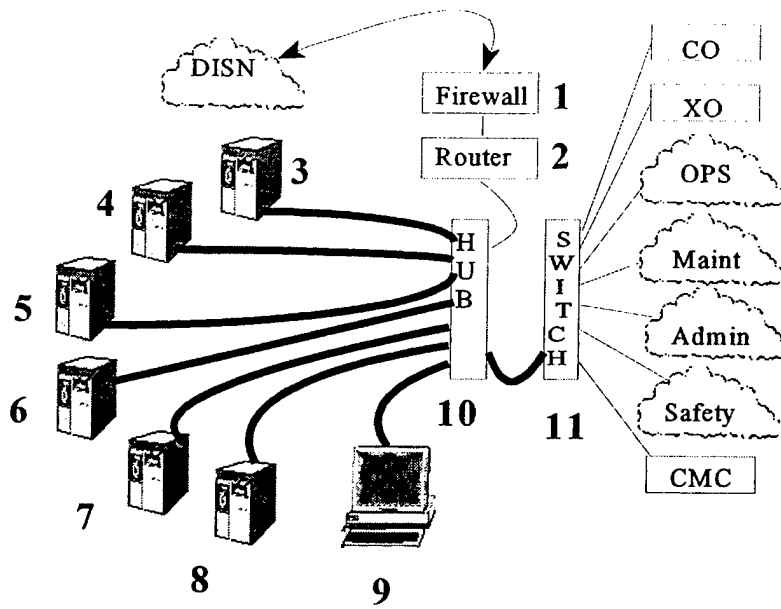


Figure 11. Recommended Squadron Network

- 1 Firewall
- 2 Router
- 3,4 File Servers
- 5,6 Application Servers
- 7,8 DMS Servers
- 9 Certification Authority Workstation
- 10 Fast Ethernet Hub
- 11 Fast Ethernet Switch

The squadron will be responsible for the following components in the network.

- Router
- Fast Ethernet Hub
- Fast Ethernet Switch
- Two Servers for DMS Software
- Associated Category Five Wiring
- Fast Ethernet Network Interface Cards
- File/Application Servers

Central Funding will be available via the chain of command for these following components in the network:

- Firewall
- User Agent/Directory User Agent
- Message Store

DISA will be responsible for these components in the network:

- Certification Authority Workstation
- Administrative Directory User Agent
- Message Transfer Agent
- Mail List Agent

VIII. CONTRACTUAL SUPPORT FOR PURCHASES

DMS and IT 21 will require the procurement of computers and network equipment at the unit level. Each command will be responsible for obtaining this equipment to meet the new requirements. But how does the squadron order the necessary equipment? There are several contracts and processes involved.

A. INFORMATION TECHNOLOGY PURCHASE AGREEMENTS

The increase in the requirement for IT products and services has led to regulatory changes that allow blanket purchase agreements (BPAs) with contractors. The Department of the Navy Chief Information Officer (DONCIO) supports BPAs. [Ref. 14] BPAs allow the Navy to obtain significant cost savings by contracting with companies who can handle fleet wide requirements. The sheer expected purchasing volume of the Navy allows contractors to offer competitive pricing and quantity discounts. To maximize purchasing power, the DONCIO has mandated the use of BPAs for IT products and services unless an unusual requirement exists. This mandate is an attempt to ensure that IT equipment procurement is efficient, cost-effective, and compliant with Navy and DOD standards and architectures. The BPA for IT 21 requirements is an umbrella contract called VIVID. The DMS contract is in place with the Air Force.

1. Vivid (Voice, Video, and Data)

To implement DMS and IT 21 at the squadron level, the command's computing infrastructure may have to be upgraded. VIVID provides a uniform method of providing

robust infrastructures for both shore commands and ships as required by IT 21. VIVID will assist the Navy in implementing state-of-the-art technology to support the DMS and IT 21 initiatives. It is designed as a tool to be utilized by the commands to meet the current and future telecommunications requirements of the Navy. Hardware and services available on the VIVID contracts will be used for modernizing the telecommunication assets to meet the demand for greater bandwidth and connectivity as the need for integrated voice, video and data networks grows and becomes essential for the warfighters.

Contracts were awarded to Lucent Technologies and GTE Government Systems Corporation of the fixed price type with economic price adjustments. Lucent Technologies received a full award providing for modernization and local access and usage. The GTE VIVID contract is limited to modernization. The GTE award excludes local access and usage services.

Historically, commands have modernized only the required portions of their computing infrastructure. Consequently, many different strategies have been used to acquire the necessary hardware, software, and services. This situation has helped to perpetuate stovepipe systems, minimize interoperability, and cause logistical support to be difficult at best. This is going to change under the VIVID contract and is a real plus for the technically challenged commands. For example, VIVID ensures that once a component is introduced into the command infrastructure, the contractor will support that component and the interoperability thereof. This will end the finger pointing about who owns the interoperability problems. While VIVID contractors are not obligated to change or modify

the commands existing infrastructure, they are obligated to troubleshoot and resolve interoperability problems caused by their components. Command responsibilities will be reduced.

Additional features of this contract are the ability to purchase, lease-to-own, or outsource the required hardware. The lease and lease-to-own alternatives allow the command's IT manager to plan according to the limitations of the Operations and Maintenance (O&M) budget.

Ordering with VIVID is strait forward. The three basic steps in the process are:

- Determine your requirements.
- For equipment, have a warranted contract officer issue a SF 1149 or credit card. Credit card orders are accepted by telephone, via e-mail, or as agreed upon by the VIVID contractor and customer.
- For services, have a warranted contract officer issue a statement of requirements to the contractor and solicit a proposal, negotiate as necessary, and then issue the order.

2. DMS Contract

The DMS contract was awarded to Lockheed Martin Federal Systems by the contracting staff at Maxwell Air Force Base. The contract is an Indefinite Delivery-Indefinite Quantity (IDIQ) contract, providing an easy ordering process to support the DMS infrastructure and user needs. Orders placed for products and services under this contract adhere to DONCIO initiatives and are excluded from the requirement to obtain

competition in accordance with Federal Acquisition Regulation 6.001 (e). The structure of the DMS contract provides for ten contract line items:

- CLIN 0001- is for program management and infrastructure. Primarily the Air Force Acquisition Project Management types will use this line item.
- CLIN 0002- includes DMS Infrastructure Software Products (Directory System Agents, Multi-Function Interpreters, Mail List Agents, Message Transfer Agents and Management Workstations) and DMS User components (User Agents, Directory User Agents, Profiling User Agents, Message Stores and Base Level Management Workstations).
- CLIN 0003- includes platforms to support the implementation of the DMS infrastructure (DISA responsibility, not command).
- CLIN 0004- includes engineering and integration services. Covers recommendations on site architecture, topology and configuration; system engineering; integration of software and hardware products; modeling and software development.
- CLIN 0005- Implementation Service Packages is primarily used to support follow on site implementations and for installing infrastructure hardware and software.

These packages are appropriate when implementation involves less than 750 users.

- CLIN 0006- Training Packages includes curriculum and documentation for training users/operators.
- CLIN 0007- covers hardware maintenance. All hardware items come with a one-year warranty. Maintenance for the hardware platforms is handled on a 7 X 24, worldwide, on call basis, with response within 24 hours (the forward deployed ships will put this concept to the test).
- CLIN 0008- covers manuals, documents, and reference guides, including the documentation for software products ordered under CLIN 0002. These items are separately priced to allow the user to purchase only the documentation that they need.

- CLIN 0009- provides for materials and travel expenses for services ordered under CLINs 0004, 0005, and 0006.
- CLIN 0010- covers the contract award fee.

These contract line items cover all the hardware, special components, training, and support required by a command to transition to DMS.

Ordering software or hardware from the contract is easy

- Use a Military Interdepartmental Purchase Request (MIPR) DD Form 448 listing the ordered items along with Lockheed Martins product number from their product guide.
- Send the MIPR along with a document providing a 4 percent fee should be sent to the Navy DMS Service Center.
- The Navy DMS Service Center forwards the package to the Air Force Central Ordering Office at Maxwell Air Force base before sending it to Loral.

3. Information Technology Electronic Commerce

While the two previously mentioned contracts specifically address DMS and IT 21 initiatives, other alternatives remain. The Information Technology Electronic Commerce (ITEC) program provides commercially available, USN standard compliant information technology (IT) products and services. ITEC Direct is the online catalog of the Navy for IT products and services. ITEC Direct leverages technology to give DOD customers a fast and easy way to electronically locate, compare, and order IT hardware, software, and services. It utilizes BPAs in accordance with DONCIO initiatives to provide convenient, cost effective one stop shopping. While a wide variety of hardware, software, and some IT support

services can be purchased here; ITEC Direct does not provide the leasing and contractor guaranteed interoperability guaranteed by the VIVID contract. ITEC's web address is <http://www.part.net/itec/itec.html>.

B. COMPARING THE AGREEMENTS

Now that we know about the various contracts, the question becomes what contract is best or appropriate for the computer products. Below is a chart that compares the contracts.

	VIVID	DMS	ITEC
Portable PCs	No	Yes	Yes
Servers	No	Yes	Yes
Networks	Yes	No	No
Peripherals	Yes	DMS Specific	Yes
Software	Yes	DMS Specific	Yes
Maintenance	Yes	Yes	Limited
Training	Yes	Yes	Limited
DMS Infrastructure	No	Yes	No
Site Survey	Yes	Yes	No

Remember the contracts offer unique hardware and software and support items but there is some overlap. The DMS contract is oriented for major commands and communication centers. The big difference between the contracts is VIVID's lease and lease to own clause with guaranteed interoperability. Support from ITEC appears to be limited.

IX. DMS TRAINING - PHASE IV

DMS Training is being developed to provide a continuation of defense messaging handling and capability through the use of current trained and experienced personnel. RMCM Curry , the training coordinator of the DMS Program Office, provides an excellent overview of DMS training options. His article [Ref. 15] provides the framework for this chapter. Training as described below covers the transitional programs from the initial and final operational capability of DMS and is available to all services, commands and activities. DMS training courses will be conducted using a variety of training methods at locations worldwide. Training courses may be taught by contractor personnel or previously trained Government personnel. The training courses may be held at contractor resident training locations or conducted at DOD sites by mobile training teams. The courses may also be available through interactive courseware and video tape media. The various types of available training methods are described in the following sections.

A. DMS COURSES

The courses outlined below, available through DISA's contract with LORAL Federal Systems, are designed to be taught at either a Government facility or by the contractor, for individual users or for/by Government Instructors:

- Basic User Training Course (User Agent Course)
- Operating System Administrator (OSA) Course
- Message Handling System (MHS) System Administrator Course

- Directory System Administrator (DSA) Course
- Management Workstation Product (MWS) Course

Users can also order any of the above training courses from commercial vendors off the DMS contract. The Basic User Training Course can be taught to a maximum of 25 students per class. All other training courses are taught to a maximum of 10 students per class.

1. Basic User Training Course

In the Basic User Training Course is an introduction to the DMS User Agent (UA) concept of military messaging and the role of the UA product. This course can be tailored to meet the needs of a specific UA. The strategic apex of the squadron, department heads, and message handling personnel should get this course. Funding for the remaining khaki is on an as needed basis. Primary message handlers could train others in the squadron. The following topics are taught in this course:

- DMS Overview
- Microsoft Mail
- Microsoft Exchange
- Messaging Concepts
- Security

2. Operating System Administrator Course

The Operating System Administrator Course provides instruction in operating system administration functions (Relational Database, Windows-NT) for local area networks.

This course includes: system initialization, operation, troubleshooting, upgrading and security procedures. The squadron IT manager should attend. The following topics are taught in this course:

- DMS Overview
- Messaging Concepts
- Security

3. Management Workstation Course

The Management Workstation (MTS) Course instructs the user in the operation of MTS products and how to perform the management of messaging and directory components. The MTS operators will be taught to identify messaging problems reported by the MTS, perform corrective and diagnostic actions to isolate and further define these problems and implement corrective measures and actions to circumvent these problems from recurring. This course also instructs the MTS operators with the ability to perform additional management functions (i.e., configuration, fault, performance, security and accounting management).

This course may be divided into separate courses providing both initial training for MTS operators who will be performing user interface (help-desk) functions, followed by more detailed training for those operators who will be performing the full range of messaging management functions. The squadron IT manager should attend. The following topics are taught :

- Configuration Management
- Performance Management
- Security Management
- Account Management
- System Planning
- DMS Overview
- Operations and Troubleshooting
- Messaging Concepts
- Security

The Message Handling System Administrator and Directory System Administrator Courses are designed for system administrators at Local Control Centers and are not normally appropriate for squadron level personnel.

B. TRAINING AND CURRICULUM DEVELOPMENT

DMS Training curriculum and requirements are being developed through the DMS contract with LORAL Federal Systems under the guidance of DISA. This contract provides the flexibility for allowing individual commands and services to tailor training requirements to meet their specific needs. Since not all commands and activities will require the full training curriculum, each user can specify what training will best serve their needs, based on a site specific survey.

X. CONCLUSION AND RECOMMENDATIONS

A. SUMMARY

This thesis has attempted to gather existing literature, filter the information, provide the relevant information in one source, and recommend an implementation strategy for a squadron. The strategy provided in this document achieves DMS and IT 21 objectives while also establishing an architecture that will be flexible for future network growth, provide group collaboration opportunities, maximize shared databases, provide large file storage capabilities, and Internet access.

Chapter I provided background for the Navy's Information Technology for the Twenty-First century program. It sheds light on the shift towards network-centric warfare and the need for the warfighters to have the computing infrastructure to support emerging requirements. Standards and guidelines for software and hardware are listed in the tables.

Chapter II provided background on the DMS program. This program will bring military messaging to the desktop and eliminate the communication centers we are accustomed to today. The architecture and components of the system are listed along with the concept of operations.

Chapter III gives insight to the benefits of information technology. DMS and IT 21 are information technology driven. The associated information technology benefits may not be apparent to the commands as we move towards networked PC based systems. Information technology provides long term benefits through information sharing, increased customer

satisfaction, increasing squadron responsiveness, and increased flexibility to achieve goals.

Chapter IV is the strategic plan and objectives. A four-phased plan was established to implement the new technologies and maximize the benefits. Phase I is to identify the strategic objectives. The objectives identified are; operational DMS system before the transition deadline, install a computing infrastructure to support DMS and future network growth, maximize group collaboration capabilities, maximize shared databases, provide large file storage capability, and have Internet access. Phase II is to define the core processes. Phase III is to organize the computer network to support the core processes. Phase IV is to revamp the training and budget to support the new capabilities.

Chapter V is divided into two areas; the current squadron structure, and the core processes of the squadron. Squadron structure was diagramed and discussed down to the functions and jobs in each department level. A good overview of how a squadron is assembled can be gathered. To determine the core processes, we examined the inputs and outputs of the squadron and departments through IDEF diagrams. By examining these diagrams we can diagnose redundant functions and outputs. The core processes of the squadron were identified as accomplishing the mission and people support processes.

Chapter VI discusses the crucial step of planning the network and recommends a network that can fulfill our strategic objectives. The network should not be assembled randomly and with no foresight. Determining requirements, evaluating current inventory, and deciding upon a software strategy are discussed. Also listed are the responsibilities for procurement of the major components.

Chapter VII provides information on contracts available to make IT 21 and DMS a reality. VIVID, DMS, and ITEC specifics and ordering information are given. The contracts are compared to give the strengths, weaknesses, and applicability.

Chapter VIII gives DMS training alternatives. Listed are various courses designed to bring individuals and commands up to speed on DMS. Recommendations are given for specific personnel to receive the training courses. The scope of the various courses are also given.

B. RECOMMENDATIONS

Many of the major initiatives (IT 21 and DMS) requirements have a tendency to be continually modified and adjusted. Therefore, the recommendations refer to a broad framework which allows for adjustments in the initiatives.

- Establish a squadron Chief Information Officer (CIO). A officer needs to be in place who has interest and understanding of computer and computer related systems. Should be a LCDR who can provide the horsepower and visibility required to drive implementation and budget issues. We must avoid current practices of assigning personnel of various ranks to manage the computer systems without a strategic plan and command support.
- Mandate use of the new network. Drive out redundant functions among the departments. Information sharing provided by the network can eliminate needless duplication of information and wasted man-hours.
- Redefine responsibilities. New processes and technology will provide an opportunity to change roles and responsibilities. Ref.[2] Seize the opportunity to cut unnecessary layers and personnel out of the process.
- Adjust and advocate. The recommended network is a guide. Unique requirements, current inventory, and changing standards will drive future growth and hardware considerations. Change as necessary. Ref.[16] When the network is adjusted, insure all personnel involved are aware of changes and how it impacts

business processes. The CIO must continually sell the command of the benefits of information technology.

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Table 1. IT 21 Applicable Squadron Level Software.

Network Operating System	NT Server 4.0/5.0
Office Software	Microsoft Office
Email	Microsoft Exchange 5.0
Antivirus	IBM
Database	Relational databases that can support web technologies (Oracle, Sybase, Access, SQL server etc.)

Table 2. IT 21 Standard PC

CPU	200Mhz Pentium Pro
RAM	64 Megabytes
Hard Drive	3.0 Gigabytes
Floppy Drive	3.5 inch
Card Reader	Dual PCMCIA
Video Card	PCI with 2 megs RAM
Monitor	17 inch (1280 X 1024) Resolution
Sound	Sound Blaster Compatible Audio Card with Speakers
Network Card	100 MBPS Ethernet

Table 3. IT 21 Standard Laptop Workstation

CPU	150 MHZ Pentium
RAM	32 Megabytes EDO RAM
Hard Drive	2.1 EIDE Gigabytes
CD ROM	6X Internal
Monitor	12.1 SVGA Active Matrix Color
Network Card	Required, But Not Specified
Other	PCMCIA Slots, Modem, Smart Lithium Battery

Table 4. IT 21 Standard NT File Server

CPU	166 MHZ Dual Pentium Pro
RAM	256 Megabytes RAM/512K Cache
Drives/Storage	(2) Four Gigabyte SCSI (1) Six Gigabyte DAT Dual PCMCIA/PC
Floppy Drive	3.5 inch
CD ROM	6X SCSI
Video Card	PCI Video with 2 Megabytes RAM
Monitor	17" (1280 x 1024)
Network Card	(2) Cabletron CPU Compatible ATM
Other	Antec Dual Power Supply Case (Hot Swapable) Two DPT SCSI III Caching Controllers (Smartcache 4)

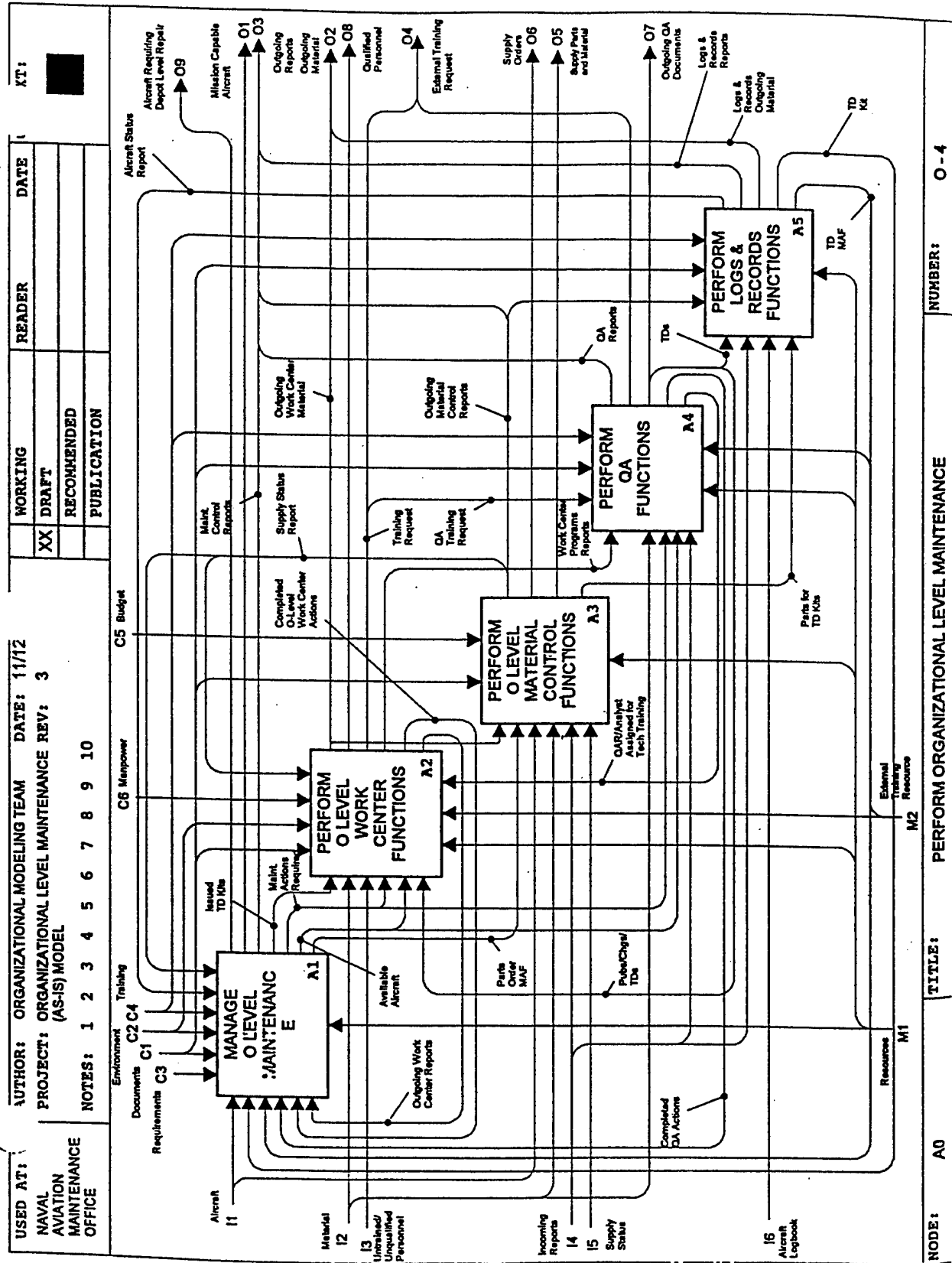
Table 5. IT 21 Standard Application/File Server

CPU	166 MHZ Dual Pentium Pro
RAM	256 Megabytes RAM/512K Cache
Storage	(5) Four Gigabyte SCSI (1) Eighteen Gigabyte DAT Dual PCMCIA/PC
Floppy Drive	3.5 inch
CD ROM	6X SCSI
Video Card	PCI Video with 2 Megabytes RAM
Monitor	17" (1280 x 1024)
Network Card	Two Cabletron CPU Compatible ATM

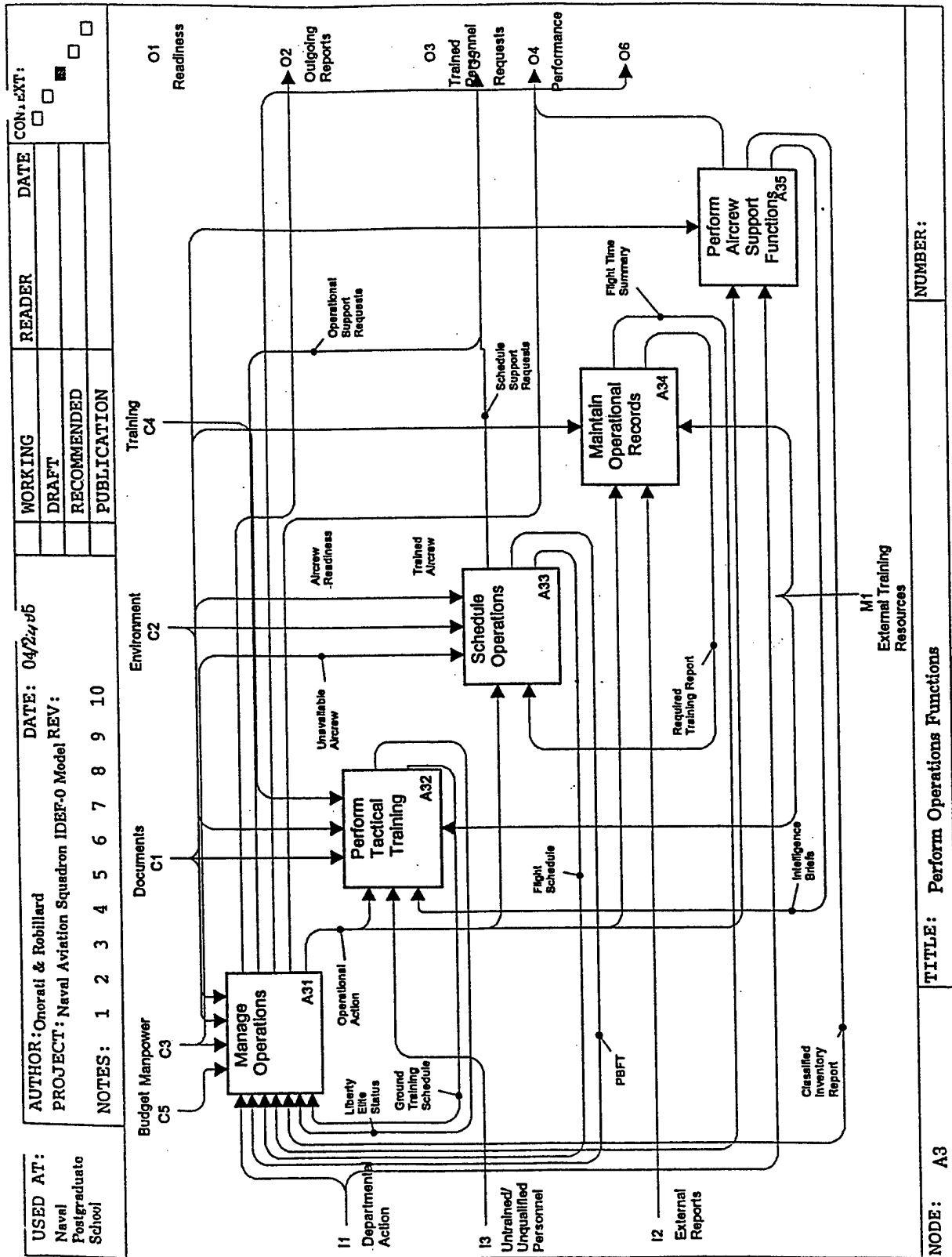
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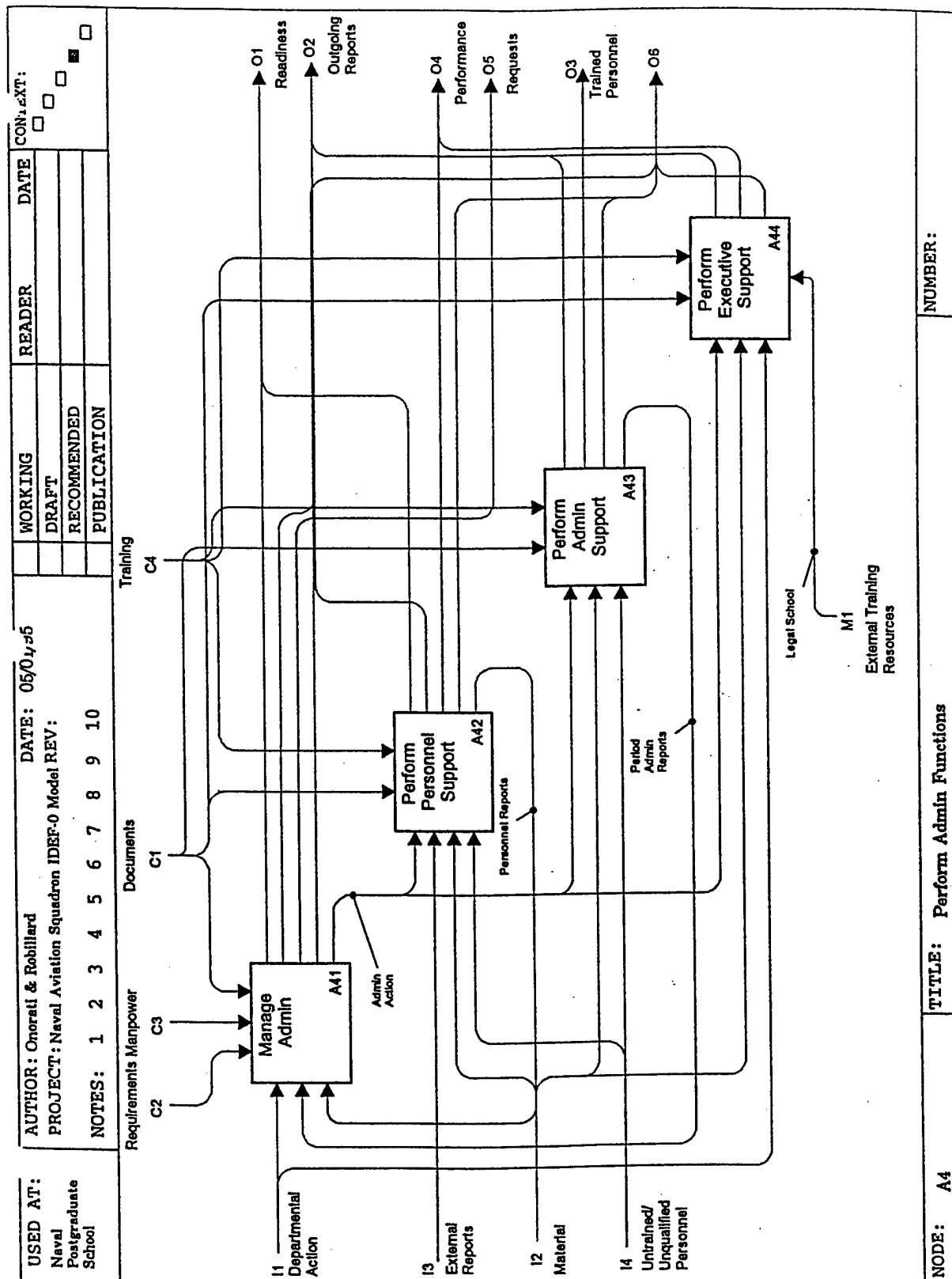
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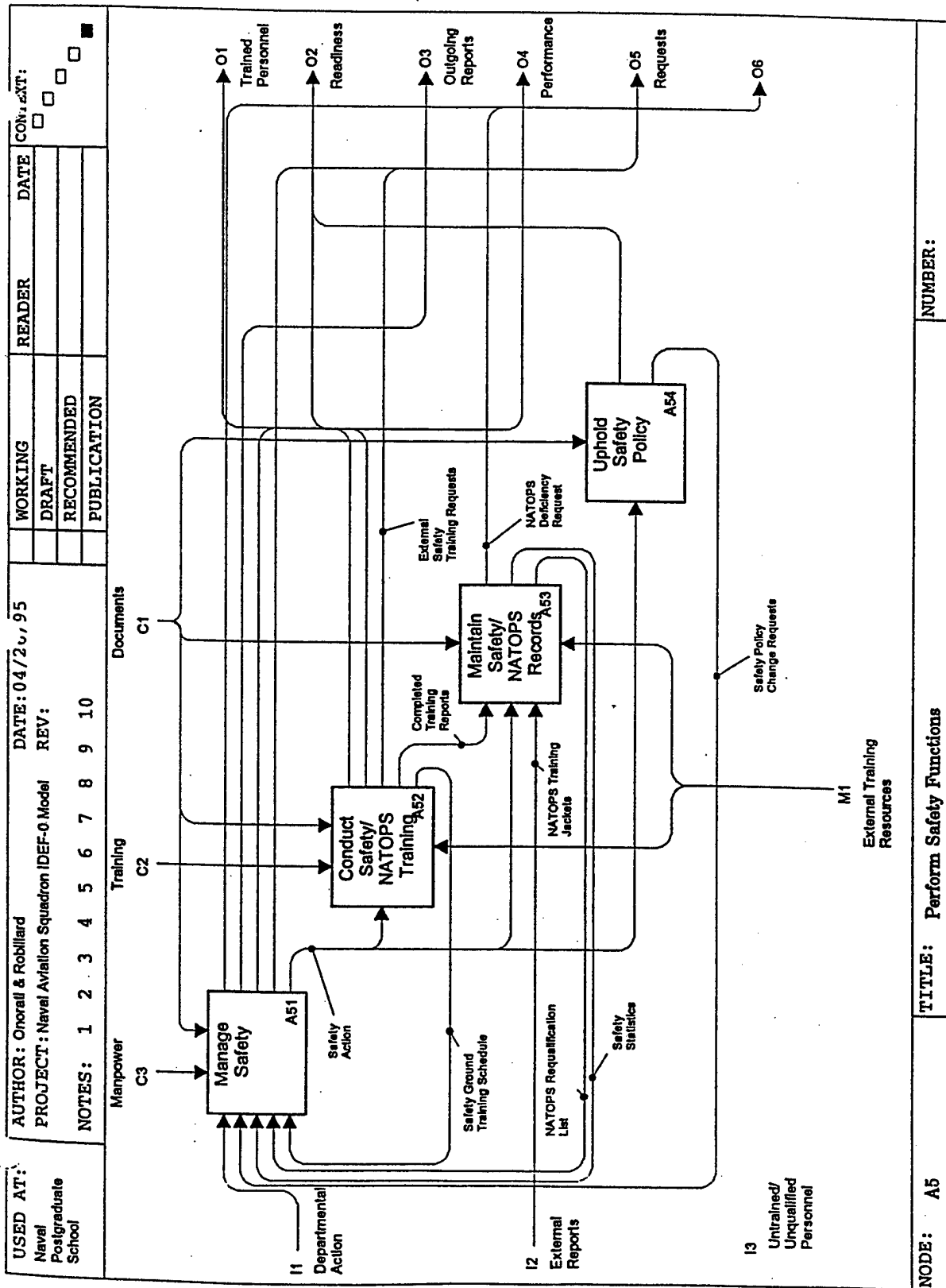
B-2. Operations IDEF



B-3. Administration IDEF



B-4. Safety IDEF



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